ERIC Document Resume	See Instruction Sheet	DATE OF RESUME 9/18/65	DATE RECEIVED

A. PUBLICATION DATA

1. ERIC NUMBER	2. ORIGINATOR CONTROL NO(S).	3. IDENTIFICATION NO.
ED001907	N.A.	N.A.

DO NOT WRITE IN SPACE BELOW

4. AUTHOR(S):
Houston Independent School District

5. TITLE OF DOCUMENT ABSTRACTED:
Course Outline for First Six Weeks of Science-Level III Talent Preservation Classes

6. PUBLICATION TITLE:
N.A.

7. EDITOR(S):
N.A.

8. PLACE OF ORIGIN
ORG. Houston Independent School District
CITY, STATE Houston, Texas
TELE. EXT.
INST/LOC CODE

9. PUBLISHER OR SOURCE
Houston Independent School District
Houston, Texas

10. VOL.	11. PAGES	12. MO./YR.	13. TOTAL PP.
N.A.	N.A.	8/64	14

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TYPE OF REPORT
PROPOSAL ☐
IN-PROGRESS ☒
FINAL ☐
FOLLOW-UP ☐

OTHER ERIC REFERENCES:

ERIC SATELLITE CODE

B. INDEXING DATA

14. SUBJECT AREA

15. TYPE OF ENDEAVOR
course outline

16. INDEXING TERMS (6-12)
science
junior high
Houston Independent School District
Houston, Texas
Talent Preservation

17. ABSTRACT (MAX. 250 WORDS)

Topics include: lithosphere, the solid part of Earth; hydrosphere, water on Earth; and atmosphere, air. Textbook references, content outline, teaching suggestions, reference readings, and audiovisual aids are given under each topic.

It is suggested that order be emphasized by providing assigned seats, requiring neat notebooks, and stressing that textbooks and notebooks be brought to class each day. Project work is of value, and Talent Preservation students often show particular interest in astronomy projects. Efforts can be coordinated with the mathematics teacher in the use of formulas.

ERIC No.

18. SOURCE OF ABSTRACT

C. FUNDING DATA

19. SUPPORTING ORGANIZATION	20. DIVISION OR DEPT.	21. CONTRACT NO. / PROJECT NO.
	22. TOTAL COST OF PROJECT	
	23. DURATION OF PROJECT	U.S. Department of Health, Education, and Welfare Office of Education

ED001907

COURSE OUTLINE

for

FIRST SIX WEEKS

of

SCIENCE - LEVEL III

TALENT PRESERVATION CLASSES

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Houston Independent School District

Houston, Texas

August, 1964

LEVEL THREE

UNIT I: MATTER ON EARTH (Approximately six weeks)

Textbooks: Davis, Ira C., John Burnett, and E. Wayne Gross. Science 3: Discovery and Progress. New York: Henry Holt & Co., 1958.

Hogg, John C., Judson B. Cross, and Kenneth E. Vordenberg. Physical Science: A Basic Course. Princeton: D. Van Nostrand Co., Inc., 1959.

TOPIC 1: LITHOSPHERE: THE SOLID PART OF EARTH

Textbook References

Physical Science, pp. 30-42; expanded reading, pp. 1-8; 43-97; 531-542; 557-589
Science 3, pp. 3-28; expanded reading, pp. 419-442; 391-416; 197-226

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Content	Suggestions
A. Systems of measure 1. The English system a. Linear b. Volume c. Weight 2. The Metric system a. Linear b. Volume c. Weight	It is important that each student in Level III Talent Preservation Science be able to use the English system of measure, and use of the metric system should also be emphasized for at least two reasons: (1) it is the usual system in science, and (2) it is a good medium through which the student can practice decimal arithmetic. It should not be expected that these students will become expert in the use of the metric system, but each should possess an appreciation of its value in science, in technical fields such as medicine, and in foreign countries.
B. The student's notebook; suggested organization: 1. Unit I a. Classwork b. Activities c. Test papers d. Project reports 2. Unit II Same order	Try to cover sub-topics A and B together. Place much weight on the importance of the notebook as a record to which the student can come for information. Have them organize the first pages in the classwork section as permanent tables of measurement. Emphasize order: Provide for regular assigned seating (except for project work), require neat and orderly notebooks, and stress the need for bringing the textbook and notebook to class each day.
C. Shape of the earth	

D. Size of the earth
   1. Circumference
   2. Diameter

E. Four motions of the earth
   1. Rotation
   2. Revolution
   3. Sun as a part of the Milky Way Galaxy
   4. Milky Way Galaxy as a part of the universe

F. Matter
   1. Definition of matter
   2. States of matter
      a. Solid
      b. Liquid
      c. Gas

G. Energy
   1. Definition of energy
   2. Kinds of energy
      a. Potential
      b. Kinetic
   3. Forms of energy
      a. Light
      b. Heat
      c. Mechanical
      d. Nuclear
      e. Chemical
      f. Electrical

H. Crust of earth (5-20 miles thick)
   1. Review of how mountains are formed
   2. Review of weathering and erosion
   3. Review of kinds of rocks

I. Atomic Theory
   1. Atomic structure
      a. Proton
      b. Electron
      c. Neutron

Using topics A and B as bases for setting up a pattern for supervised study and for determining the level of mathematical ability of each student. Coordinate this work with the mathematics teacher to develop consistent procedures in the use of systems of measure.

Since Talent Preservation students often show a remarkable interest and capacity concerning certain aspects of astronomy, you should find a strong readiness to assume project work concerning the motions of the earth. By reminding the students of the need for project reports to the class, you can introduce a review of the major concepts concerning the earth's identity in space. You may also use similar procedures for reviewing the basic concepts of geology. The emphasis here is for each student to comprehend the earth's existence as a relatively isolated concentration of matter in space, a measurable composite of measurable objects. Emphasize the fact that man's own senses limit his scientific analysis of earth; that is, they permit him to measure only those things that occupy space (matter) or exert force (energy).

Proceed in the study of matter and energy just far enough to distinguish the two, so that the students can refer to and apply the terms correctly. Point out that in this unit we are mainly concerned with matter—how to measure it, how to classify its existence on earth, and how such existence relates to potential and kinetic energy.

Involve the students in discussions concerning the content of this topic, keeping an eye out for stereotyped views that you can bring into question and analysis. Try to launch the students into project work pursuing such questions as:

1. How were mountains formed on this continent?
2. How deep is the bedrock in the Houston area?
3. What elements combine to form sand?

2. Kinds of elements
   a. Radioactive heavy elements
   b. Chemically active lighter elements

3. Classification of atoms
   a. By atomic number
   b. By atomic weight

J. Molecular theory

1. Combination of metals with non-metals to form compounds

2. Definition of a molecule

3. Sand—silicon and oxygen

4. Common metal ores

K. How man depends on Chemistry

1. Industry

2. Medicine

3. Scientific farming

L. Oxygen—the dominant element on earth

M. Mixtures and solutions

N. Classifications of chemicals

1. Organic, inorganic

2. Metals, non-metals

3. Acids, bases, salts

4. The "ides" and "ates"

O. The field of Physics

1. Physical properties

2. Chemical properties

4. Where did Lake Houston water come from in the first place? How many changes in the state of matter did it undergo during its trip here?

5. How do we account for heavy elements being heavy? What is meant by "atomic weight"? "atomic number"? What is the heaviest element in nature?

6. How can we justify the atomic theory?

7. Is sound a form of energy all by itself?

8. What are some industries that specialize in separating metals from their ores?

9. Why is gold often found in pure form in nature?

10. What elements lie near the center of earth?

11. What are the five most common elements on earth?

12. What were the early beliefs concerning the thickness of earth's crust? What factors caused scientists to change their minds?

13. What forms of energy exist in a volcano? What states of matter?

14. What kinds of mining are done in Texas?

15. What is the history of oil in Texas? Why do we have refineries? Where does natural gas come from?

16. What is meant by the term "active element"?

17. What form of energy is oil the source of?

18. What are the main chemical industries in Houston?

3. Special areas of Physics
   a. Electricity
   b. Mechanics (per forms
   c. Nuclear of energy)
   d. Light
   e. Heat

19. What are the kinds of chemical reactions? How are they used in cooking and around the house?

20. What is the difference between matter and energy? Between force and mass?

P. The ten most common elements—how they exist in nature

You will be able to move some students beyond the scope of this outline. Others will have trouble keeping up with it. In a way, this is good, because it will allow leadership to develop. Try to move leaders into project work with those who are withdrawn, so they can be identified as part of a moving group.

Insist on the taking of notes whenever a project is being reported.

Conduct topic summaries in ways that will require preparation, such as contests based on word lists, debates, and project fairs.

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Audio-Visual Aids

Films

1719	"A" Is for Atom....C..15 min.	L2040	Story of Copper.....33 min.
L1698	The Atom Comes to Town.....C..35 min.	L2041	Story of Gasoline.....23 min.
1716	The Atom Goes to Sea..12 min.	1914	Treasures of the Earth.....C..11 min.
L2145	Cosmic Rays.....C..29 min.	74	Volcanoes in Action....11 min.
L1599	Petrified River (Story of Uranium)..35 min.	80	Work of Atmosphere.....11 min.
L1833	Strange Case of the Cosmic Rays(Part I).	L2043	Zinc: Its Mining.....10 min.
L1834	(Part II—Strange Case of the Cosmic Rays.....C..60 min.	2027	The World of Molecules.....C..11 min.
1904	The Face of the Earth.....C..13 min.	M1619	A Story of Lead.....22 min.
1873	Chemistry and a Changing World.....11 min.	2036	How We Know the Earth's Shape.....C..11 min.
M2302	Explaining Matter: Atoms and Molecules.14 min.	491	Wonders of Chemistry...11 min.
		2278	Our Natural Resources.C10 min.
		M1398	Yours Is the Land...C..20 min.

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Filmstrips

Fs-779	Atomic Energy (Basic Information)	Fs-920	Our Earth Is Moving
FsG-2134	Some Properties, Structures, and Changes in Matter——Series 7	Fs-857	We Live on a Huge Ball
		Fs-2023	Introduction to Chemistry

FsG-2145 Some Properties, Structures, and Changes in Matter——Series 8
Fs-1706 Careers in Science——Chemistry
Fs-1705 Careers in Science——Physics
Fs-921 Our Changing Earth

FsG-2350 The Chemistry of Iron
FsG-2351 The Chemistry of Steel
FsG-2352 The Raw Materials of Steel Making
FsG-2127 Rocks, Soils, and Minerals, Series 7
FsG-2138 Rocks, Soils, and Minerals, Series 8

Transparencies

Tr-1000 Atomic Structure

Exhibits

Ex-1 Rocks and Minerals

TOPIC 2: HYDROSPHERE: WATER ON EARTH

Textbook References

Physical Science, pages 9-19; 215-223; 333-344; expanded reading, pages 224-231.
Science 3, pages 147-194.

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Content	Suggestions
A. Water cycle 1. Ratio of water surface to land surface on earth 2. Evaporation 3. Condensation 4. Precipitation 5. Streams and rivers	Allow for overlapping between the topics of this unit. Let some students start project work in this area while you are still officially covering topic 1. This will help scatter positions of authority, so that when you have class discussion, leadership will pass from student to student; moreover, it will be taken from the talkers and placed in the hands of the doers. Overlapping of unit content requires that you maintain regularity in class routine. Have at least one project-report day per week.
B. Water as a compound 1. Hydrogen + oxygen = water 2. Metal + water = base 3. Base + acid = salt + water 4. Electrolysis of water	Arrange for projects to be reported in correlation with your own plans for presenting all of a topic's content to all of the students. This means that you must insist on responsible research, reports, and taking of notes. Have definite procedures set up whereby those who have been absent may catch up on notes and make late project reports.
C. Water: the universal solvent 1. Salt and sugar water 2. Hard and soft water a. Ground water b. Rain water	Bear in mind that the atomic and molecular theories are the basic content for Level III science, just as the seven life functions were the basic content for Level II. You will always be turning projects and discussions in their direction. Some students will pursue them as far as regular classes do.
D. The water table 1. Capillary action 2. Cohesion and adhesion 3. Soils that best hold water	There are a number of good laboratory experiments on water. Topic B can be covered very well through pupil reports and demonstrations. developed by following the regular ninth-grade laboratory manual. However, it would be wise to supervise such project work closely, using this time to teach the basic methods for use of apparatus and chemicals. Do not allow students to prepare acids, and do not allow project work to be done in the stock room.

E. Density

1. Water = 62.4 lbs/ft^3
   = 1 gram/cm^3

2. Formula for density

3. Specific gravity (where water is the standard)

F. Water distribution

1. Water pressure

   $$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

2. Gravity system

3. Pumping system

4. Combination system

5. Houston's water distribution systems

G. Purifying water

1. Aeration

2. Distillation

3. Filtration

4. Sedimentation

5. Chlorination

6. Lime-soda treatment

H. Water purification methods in Houston

I. Plumbing

1. The faucet

2. The toilet

3. Disposal of wastes
   a. Cesspool
   b. Septic tank
   c. Houston's sewage system

Use calcium turnings in the preparation of a base—nothing more active. Keep a "check-out" book, a notebook showing who has been checked out as being competent in the use of various pieces of equipment. Be consistent in requiring each student to "check-out" on a piece of apparatus before he uses it. This will help to develop other positions of authority within the group.

Plan to devote at least one day a week to supervised study. Be sure that each student is able to use the glossary and the index of the textbooks. Supervised study requires careful planning and preparation by both the teacher and the students, and consistent, well- understood procedures. Instead of making rigid homework assignments, try to inspire independent out-of-school activities, such as a collection of clippings, drawings, papers, and specimens. Distinguish this type of activity from the formal research project. These smaller, more or less spontaneous activities can best be kept in the notebook, and should be evaluated as a part of it, whereas the formal projects will require both presentation and written report, and be evaluated as a part of actual classwork. Reward the student with pluses or checks in the grade book for such activity work, and with actual grades for project work. Expose the grade book at regular times (under a plate of glass) so that the doers can gain stature.

Coordinate your efforts with the mathematics teacher in the use of formulas. Let science furnish the media for applying mathematics to the study of density and pressure. Point out the difference between mass and weight, and between gravity and centrifugal force. Move the students toward projects that pursue such questions as:

1. Why would I weigh more at the North Pole than at the Equator?

2. What is a good water pressure for a home faucet? For a fire engine hose?

3. What does specific gravity have to do with a car battery?

J. The water meter

K. Hydraulic devices

4. What is buoyancy? How does it relate to density?

5. Why is distillation not a good way to purify drinking water? Why is running water purer than stagnant water?

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Audio-Visual Aids

Films

2473	Geological Work of Ice	C..11 min.
L2144	Challenge of the Ocean	C..29 min.
33	Ground Water	11 min.
1162	What Makes Things Float?	11 min.
M2341	Chemistry of Water	11 min.
L1712	Pipeline to the Clouds	10 min.
M1014	Water for Dry Land	20 min.
275	What Makes Rain?	12 min.
M2477	Finding Out About the Water Cycle	C..13 min.
L1504	Clean Waters	C..21 min.
M2105	The Screen New Digest: September—1961	20 min.
1513	Water Supply	11 min.
1874	Irrigating Farming	11 min.
1425	Your Friend the Water	C.. 6 min.
101	Water Power	11 min.
1514	Treasures in Snow	C.. 6 min.
81	Work of Rivers	11 min.

Filmstrips

FsG-2128	Air and Water——Series 7
FsG-2139	Air and Water——Series 8
Fs-726	What Makes Rain?
Fs-1469	Problems of Pollution
Fs-952	Robert Fulton
Fs-1388	Story of Ice and Glaciers

TOPIC 3: ATMOSPHERE: AIR

Textbook References

Physical Science, pages 20-29; 204-214; expanded reading, pages 148-203; 367-376.
Science 3, pages 29-60; 66-71; expanded reading, pages 123-146.

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Content	Suggestions
A. Atmospheric layers 1. Troposphere (most weather) 2. Stratosphere (molecular) 3. Ionosphere (ionic) 4. Exosphere	The first part of this topic deals with the physical aspects of air. The last part will deal with the chemical aspects. Emphasize that though the atmosphere extends several hundred miles from the surface of earth, about 99% of it exists within the first 20 miles. Distinguish the layers of atmosphere so that the student will associate the Troposphere with the phenomena of life and weather, the usual medium for air travel. Describe the Stratosphere as being rare but still molecular in nature. Explain the difference between molecules (and atoms) and ions.
B. Density of air 1. 1.3 ounces/ft^3 at sea level 2. Variation with altitude	
C. Atmospheric pressure 1. 14.7 lbs/in^2; 30 inches of Hg a. Exertion in all directions b. Decrease with altitude c. Use of the altimeter 2. Measurement of atmospheric pressure a. Mercury barometer b. Aneroid barometer 3. Man's uses of atmospheric pressure a. Human lungs b. Vacuum cleaner c. Soda straw d. Lift pump	Stress the facts that air really has weight and that it is in a gaseous state of matter. Point out how the "state" is a physical property of matter. Move students toward projects involving the analysis of home appliances that make use of atmospheric pressure. Numerous demonstrations can be conducted along with your class discussions. Let the students pair up on such demonstrations and use them in formal project reports to the class. In some cases, you will be able to issue materials to the whole class and conduct a laboratory session. It would be wise, however, to keep laboratory work closely associated with teacher demonstrations or project reports. Establish a consistent experiment procedure and use it as laboratory routine. Reproduce some forms for this purpose. Don't let yourself

D. Air pressure

1. Compression pump

2. Pneumatic tools
   a. Air brakes and air guns
   b. Drills and sprayers
   c. Door checks

E. Composition of air

1. Oxygen—21%

2. Nitrogen—78%

3. Carbon dioxide and others—1%

F. Oxygen

1. Combination with surface metals on earth
   a. ores
   b. rust

2. Respiration—slow oxidation in life process

3. Fire—rapid oxidation

4. Production of oxygen
   a. Decomposition of oxygen compounds
   b. Photosynthesis

G. Water displacement by oxygen, hydrogen, and carbon dioxide

1. Collection

2. Tests

H. Nitrogen

1. Level of chemical activity

2. Nitrogen for life
   a. Proteins
   b. Nitrogen-fixing bacteria
   c. Commercial fertilizers

become the source of informations. Instead, draw the materials for the write-ups from the class. Issue project report forms when a student is presenting a report or demonstration, and have the students enter them with the classwork in their notebooks. Issue experiment procedure forms when you conduct a demonstration and have these also entered with the classwork.

Talent Preservation students enjoy competition. Arrange to have a project fair at the end of each unit (each six-week period). Offer prizes in the form of certificates and trophies. This is a good way to bring adults from the school administration and the community into positive relations with the class, as judges.

Debates also generate intense interest and preparation. Be sure to have an established routine for this. Again, you may be able to arrange for adults to act as judges. Insist on formality.

Move the students toward projects that pursue such questions as:

1. How much does the air in this room weigh?

2. What layer of the earth's atmosphere is the usual medium for man-made satellites?

3. How can we prove that atmospheric pressure moves in all directions?

4. Is there really any such thing as "suction"?

5. Why must one distinguish between "air pressure" and "atmospheric pressure"?

6. What is Bernoulli's principle? How does it relate to atmospheric pressure, in explaining how airplanes fly?

7. What is rust? What is oxidation?

8. How does life help maintain the balance between oxygen and carbon dioxide in the air?

3. Explosives (do not formulate)

I. Importance of air to man

J. Importance of air to plants and animals

K. Man-made atmospheres

1. Caisson

2. Space ship

9. What keeps air from falling off of the earth?

10. Is air a compound, a mixture, or a solution?

11. Why is it that a lift pump cannot raise water from a well more than 33 feet deep?

12. Why does warm air rise? Is it more or less dense than cold air? How is air buoyancy implicated in weather? By balloons?

13. What is the chemistry of photosynthesis?

14. What are the ten most common oxygen compounds?

15. How does the earth's rotation influence the motion of air?

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Schwartz, Julius. It's Fun to Know Why: Experiments with Things Around Us. McGraw, 1952.

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Audio-Visual Aids

Films

1528 Air Around Us.....11 min.
M2433 What Makes Weather..C..12 min.
M2434 Be your Own Weatherman.....C..12 min.
1347 Tornado (Spotlight on Texas) .....11 min.
80 Work of the Atmosphere.....11 min.

Filmstrips

Fs-2058 Clouds, Rain, and Snow
Fs-1483 The Air Age
FsG-2128 Air and Water——Series 7
FsG-2139 Air and Water——Series 8
Fs-1722 The World Around Us, International Geophysical Year

Consult the latest Audio-Visual Materials Catalog for other listings.